

Biggest fleet 2024



FieldBots would like to thank the worldwide partners of the ranking.





ZACO HCM

PHILON Service Robotics AG KENTER

F igefa NEXT fmrobotics

JUSMER plus

MAN ANA

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KILLIS

Commercial & Industrial Cleaning Equipment

cleanfix SWISS MADE QUALITY

ROBOTIC CLEANING SOLUTIONS

POLOR

W-ROBOTICS.COM

cleanfix SCHEVARAN SWISS ENGINEERING

BIB ROBOTICS

REEMAN AI IN ACTION

KEENON

RAAS PAL ROBOT AS A SERVICE

safic

Editorial



Dear Readers,

So here it is, the first magazine for the first “The Biggest Fleet” ranking. And forgive me for speaking LinkedIn: what a ride it was. The idea for the “The Biggest Fleet” was quickly born, the international partners were convinced almost as quickly, and then ...

... you can read about what happened next on page 6. However, the disillusionment of fighting for every fleet was quickly replaced by enthusiasm for our learnings. We believe that everyone should benefit from what we learn. So, enjoy our little magazine. And see you next year at the latest – because we’ll keep the ranking going!

Yours

Alexander Feil



No time to read?

Whether on the plane, in the car, or secretly in a boring Zoom meeting, the most critical learnings from “The Biggest Fleet 2024” are also available in audio format.

<https://youtu.be/UNtCabedsb4>

Or scan the QR code

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On the attempt to create a ranking for the industry

Admittedly, we had imagined it to be more accessible. Maybe because we are hopeless optimists or the general industry sentiment regarding “The Biggest Fleet 2024” was more than encouraging. We quickly found more than 20 partners worldwide who wanted to support us in our search for the largest cleaning robot fleets in the world.

The promising start was followed by a reality check:

1. The number of substantial fleets worldwide is still relatively modest
2. Contrary to grandiose press announcements, many installations have not yet progressed beyond a test phase
3. In retail, individual branches have started test rollouts, but there is still a lack of strategic will to implement them at corporate headquarters
4. While the number of human employees is publicly shared on most websites, information about the use of robots is considered business-critical and worthy of secrecy
5. Many cleaning companies are concerned about being left behind compared to the competition and, therefore, shy away from going public. Please also read our article on page 15, “Industry sentiment”.

The submissions only trickled in, the network was surprisingly quiet, and the result of “The

Biggest Fleet 2024” was not yet where we wanted it to be. But you probably already suspect it: there is a hopeful “but” after these sentences:

1. We have gained a lot of exciting insights – and we are sharing them with you

On our way to the first worldwide ranking of cleaning robot fleets, we learned a lot about the industry’s actual status quo and drew our conclusions from it. All seven learnings are at the end of the ranking.

2. We are not giving up

Our conviction has not changed. For cleaning robotics to gain a firm foothold, the players need to assess themselves realistically, and the status quo needs to be presented realistically without being distorted by PR.

3. We are redesigning the ranking

We will free the ranking from its rigid structures. We will maintain it throughout the year and support it with a publication like this one at the end of each year, with further information and interpretations. We hope this persistence of the initiative will increase its acceptance year after year.

Ranking

As of November 15, 2024

	Fleet Operators	Country	Robots	Microbots	Aggregated	Manufacturers
1	Phillips 66 ²⁾	USA	7000	0	7000	ICE Cobotics
2	Walmart ²⁾	USA	1850	0	1850	Tennant
3	Travelodge ²⁾	GBR	0	7500	1500	KILLIS
4	Kum & Go ²⁾	USA	400	0	400	ICE Cobotics
5	Sam's Club ²⁾	USA	372	0	372	Tennant
6	FamilyMart ²⁾	JAP	300	0	300	BIB
7	Mitie ²⁾	GBR	72	800	232	Perfect Little Company, Gausium
8	Flagship Facility Services ²⁾	USA	100	0	100	SoftBank
9	SMRT ²⁾	SGP	89	0	89	Avidbots, LionsBot, Gausium
10	Daiei ²⁾	JAP	79	0	79	SoftBank
11	Schnucks ²⁾	USA	78	0	78	Tennant
12	Apleona Infra Services GmbH ¹⁾	GER	68	4	68.8	Kärcher, Hako, SoftBank, LionsBot, Gausium
13	Geiger Facility Management ¹⁾	GER	28	152	58,4	i-Team, ICE Cobotics, LionsBot
14	Group Atalian ²⁾	FRA	55	0	55	Gausium
15	Huazhu Group ²⁾	CHN	50	0	50	Gausium

	Fleet Operators	Country	Robots	Microbots	Aggregated	Manufacturers
16	ROSSMANN ²⁾	GER	45	0	45	Gausium
17	Albert ²⁾	CZE	40	0	40	Tennant
18	Pharmaceutical Company ³⁾	GER	0	171	34.2	Cleanfix, iRobot
19	Veolia Solutions Deutschland GmbH ¹⁾	GER	32	0	32	LionsBot, Gausium
20	MAXI	SER	30	0	30	Gausium
21	Race Track Travel Centers ²⁾	USA	25	0	25	ICE Cobotics
21	Millenium Services Group Limited ²⁾	AUS	25	0	25	Avidbots
23	Obayashi Corporation ¹⁾	JAP	20	0	20	Kemaro
24	Dorfner Gruppe ¹⁾	GER	18	7	19.4	Gausium, i-Team, SoftBank, Cleanfix, Kärcher, Tennant
25	Incheon Airport ²⁾	KOR	12	0	12	Gausium
25	Medirest ²⁾	GBR	12	0	12	LionsBot
27	Bowling Green State University ²⁾	USA	9	0	9	ICE Cobotics
28	Healthcare Company ³⁾	USA	0	43	8.6	Cleanfix
29	Bright Blue Whale World ²⁾	CHN	7	0	7	Gausium
30	J&H Family Stores ²⁾	USA	6	0	6	ICE Cobotics
31	Healthcare Company ³⁾	CHE	0	29	5.8	Cleanfix
32	Hospitality Company ³⁾	SGP	0	27	5.4	Cleanfix

	Fleet Operators	Country	Robots	Microbots	Aggregated	Manufacturers
33	Facility Management Company ³⁾	AUT	0	26	5.2	Cleanfix
34	Da Nang Airport ²⁾	VNM	5	0	5	Gausium
35	Queen Alia International Airport ²⁾	JOR	4	0	4	Gausium
35	Trafford Centre Manchester ²⁾	GBR	4	0	4	LionsBot
37	KLR GMBH Reinigungs- & Hygienetechnik ¹⁾	GER	2	5	3	ICE Cobotics, ZACO
38	Penn State University ²⁾	USA	2	0	2	CenoBots
38	Chhatrapati Shivaji Maharaj International Airport ²⁾	IND	2	0	2	Peppermint
40	VAHLE Group ²⁾	GER	2	0	2	Cenobots

Information about the source

- 1) Verified submission by ranking participant
- 2) Press article / press release see appendix
- 3) FieldBots OS verified

Appendix

Albert:

https://www.robotics247.com/article/albert_czech_republic_deploys_40_autonomous_tenant_scrubbers_brainos

Atalian:

<https://europaproperty.com/atalian-signs-global-agreement-with-gausium-to-redefine-cleaning-with-technology/>

Bowling Green State University

<https://nbc24.com/news/local/bgsu-adopts-autonomous-floor-cleaning-robots>

Bright Blue Whale World

<https://www.instagram.com/gausiumofficial/reel/C2t0BLNxALs/>

Chhatrapati Shivaji Maharaj International Airport

<https://www.internationalairportreview.com/news/223107/autonomous-cleaning-robots-enhance-hygiene-at-csmia/>

Appendix

Daiei:

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FamilyMart:

<https://asia.nikkei.com/Business/Retail/Japan-s-FamilyMart-to-roll-out-cleaning-robots-at-300-convenience-stores>

Flagship Facility Services:

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Huazhu Group:

<https://gausium.com/case/chinas-hotel-giant-boosts-business-success-with-gausium-vacuum-40-diffuser/>

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<https://cstoredecisions.com/2023/02/06/kum-go-to-integrate-cleaning-robots/>

MAXI

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Mitie:

<https://www.mitie.com/wp-content/uploads/2023/07/Mitie-ESG-Report-2023.pdf>

Phillips 66

<https://icecobotics.com/press-release/ice-cobotics-teams-with-phillips-66>

Penn State University

https://www.linkedin.com/posts/activity-7262558742389387265-TY0-?utm_source=share&utm_medium=member_desktop

Queen Alia International Airport

<https://www.zawya.com/en/press-release/companies-news/airport-international-group-partners-with-mena-facilities-management-to-deploy-high-tech-cleaning-robots-at-qaia-o00xshq4>

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Schnucks

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Walmart:

<https://roboticsandautomationnews.com/2019/04/10/brain-corp-to-supply-another-1500-floor-cleaning-robots-to-walmart/21817/>

Further Information

How we calculate the “Aggregated” column:

The aggregated number of microbots and robots is the decisive factor for placement in the “Biggest Fleet 2024” ranking. The division between microbots and robots is made to account for the widely varying investment costs. All FM robots with a purchase price of less than \$10,000 before tax are counted as microbots. Large robots are counted as the equivalent of 5 microbots.



Do you want to participate?

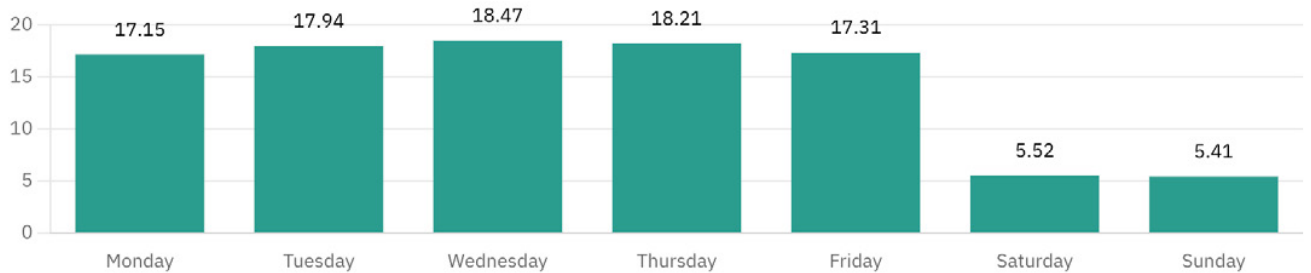
Show the world that your company takes robotics seriously and spend a few minutes to become part of the only ranking for cleaning robot fleets.

FieldBots OS Data

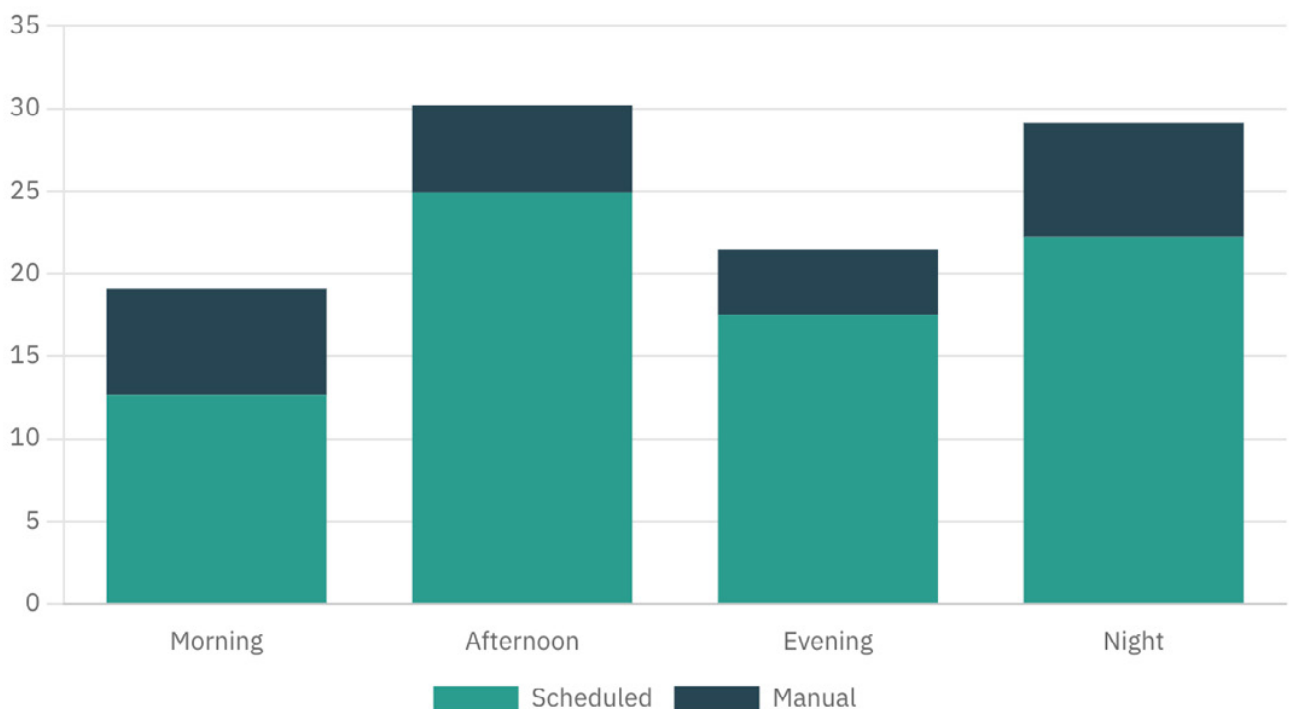
We mine the data trove for you

We collect hundreds of thousands of data points daily in FieldBot's OS. Each connected robot reports its work and performance data to the cloud. These data provide valuable insights. We want to share the most exciting ones with you:

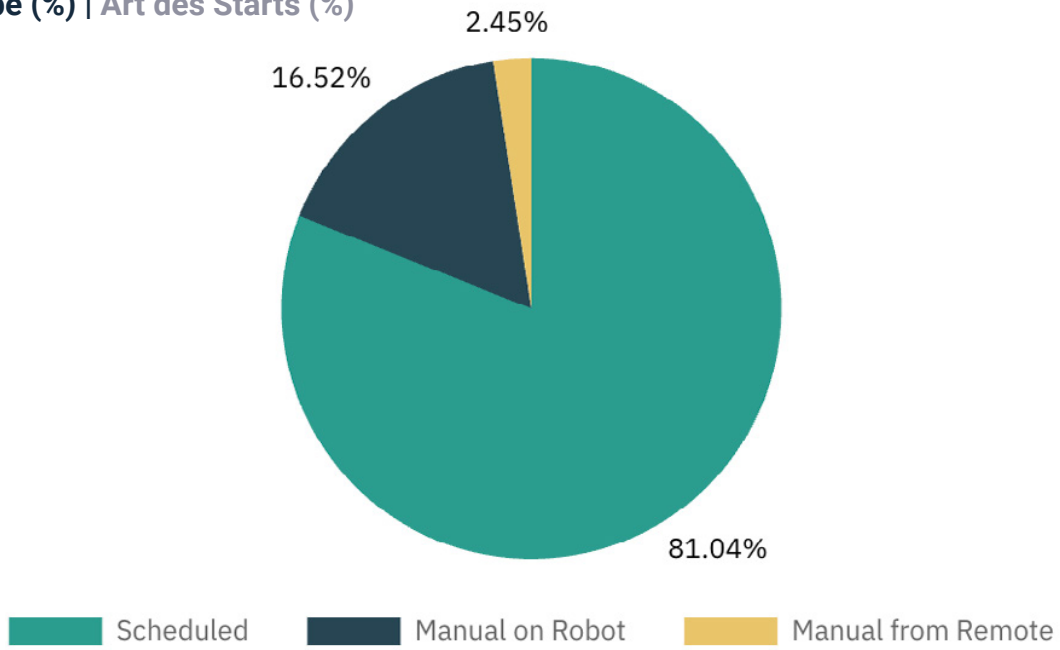
Runs per Weekday (%) | Läufe pro Wochentag (%)



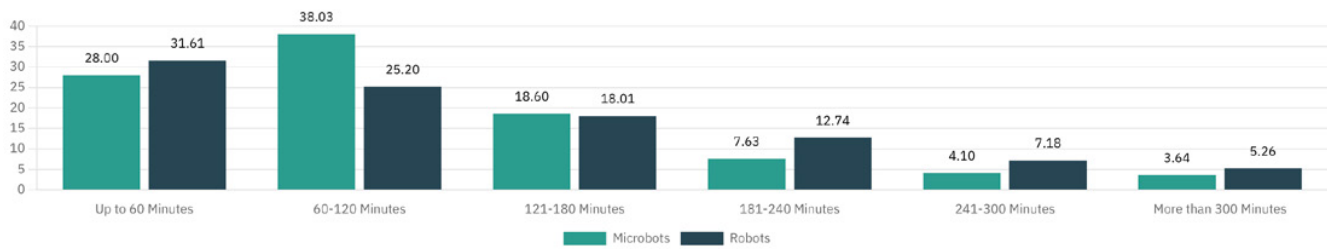
Time of Day (%) | Tageszeit (%)



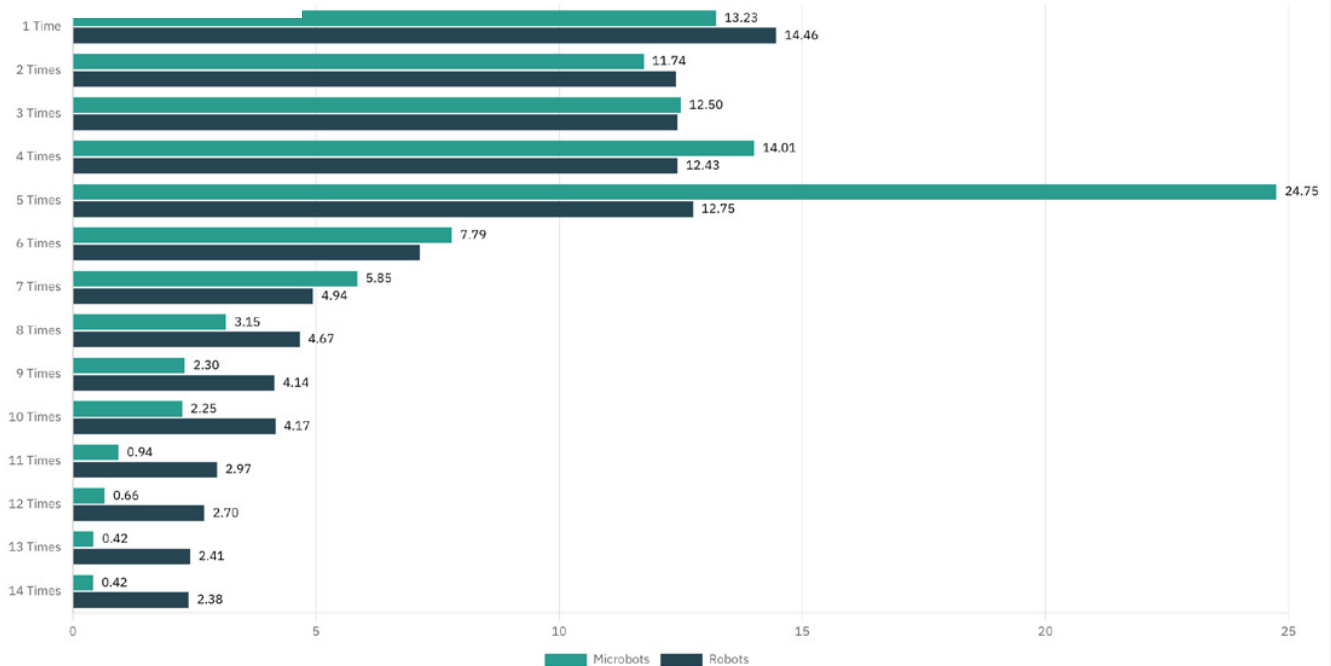
Run Type (%) | Art des Starts (%)



Daily Duration (%) | Tägliche Einsatzzeit (%)



Amount of Runs per Week (%) | Anzahl Reinigungsläufe pro Woche (%)



Our learnings

On our way to the first ranking for cleaning robot fleets, we made hundreds of phone calls, wrote even more e-mails, and sent a research team to look into the media coverage of the last three years. In addition to the hard facts of the fleet table, we learned a lot about our industry, the status quo of robotics, and prospects during the process. Below, you will find our seven learnings.



**Industry
sentiment**



**David and
Goliath?**



**Fear of
robotics**



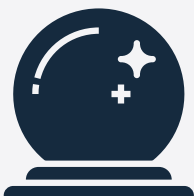
**International
markets**



**Which
manufacturers?**



**Which sectors
perform?**



**10 theses on the
future of cleaning
robotics**

The cleaning industry is under pressure to keep pace with the rapid development of automation. In addition to the feeling of needing to catch up to other sectors, such as logistics, there is a growing concern in the cleaning industry that competitors may already be further along in integrating cleaning robotics. Interestingly, there is also a distorted perception of automation progress in other parts of the world. While North American companies said they lagged behind Europe in cleaning robotics, European contacts often assumed North America was already fully automated. We very frequently encountered this unsettling mix of assessments in our one-on-one discussions. Undoubtedly, it has led to a reluctance among many companies to talk openly about their status in cleaning robotics.

1. The concern of large cleaning companies

Large cleaning companies see opportunities and a significant risk to their market position in cleaning robotics. In tenders, customers increasingly demand a higher degree of service automation and are increasing the pressure to innovate year after year.

2. The concern of small cleaning companies

Smaller cleaning companies see themselves as disadvantaged in robotics because they have fewer resources than large competitors. High investment costs and uncertainty about the return on investment (ROI) make starting challenging. In an increasingly technology-driven market, some cleaning companies fear being left behind

because they need more capacity to compete with larger, better-capitalized companies.

3. PR announcements and flagship projects

Success stories from competitors about the successful use of cleaning robotics also increase internal pressure in many organizations. Although PR announcements often fail to mention actual figures, such marketing noise understandably makes it difficult to make an exact, fact-based assessment of one's own company.

4. The predicted importance of robotics prevents open industry exchange

The prediction that robotics will play a crucial role in the future of the cleaning industry means that information about the use of cleaning robots is considered business-critical. Companies often hesitate to publicly share their strategies and experiences for fear of losing valuable competitive advantage or revealing competitive disadvantages. Even in our industry, which regularly publishes revenue figures, ESG metrics, and much more, cross-organizational sharing on robotics often remains wishful thinking. ■

Learning 2

David and Goliath?

Admittedly, our cover graphic for learning 2 conveys a certain sense of antagonism. However, our ranking and international industry feedback suggest an essential lesson to be learned: Microbots and robots are rarely thought of together. Numerous fleets are limited to one type of robot. While some see the low-cost microbots merely as tripping hazards, others purchase entire swarms of small vacuum cleaner robots. We have juxtaposed both prevailing opinions.



Recap: What are microbots?

Microbots are small, professional cleaning robots that usually cost under \$10,000 and are so compact that they easily fit into a DHL or UPS package box. These robots are used primarily in environments where larger machines would be problematic due to the rooms' limited size and high complexity – for example, in offices with a lot of furniture or in hotels.

Some manufacturers have already specialized in the microbot segment. These include i-Team, Nexaro, Cleanfix, and ZACO. The German cleaning machine giant Kärcher also has a small professional robot in its range, the KIRA CV 50.



The CLEANFIX S170 Navi is an example of a microbot-class device (Photo: FieldBots)



Moritz Fendt, Founder & CEO FENKA Robotics

“With a ratio of 5:1, microbots are still overrated in the aggregated weighting in the ranking.”

With a ratio of 5:1, microbots are still overrated in the aggregated weighting in the ranking. In FENKAS's rental business in German-speaking countries, microbots have played a minor role. Our daily interactions with building service providers show a strong trend toward robotizing walk-behind and ride-on machines. Of course, we also regularly travel in Asia and worldwide to see the latest developments. So far, little has convinced us of the need for a large-scale entry into microbots.

Opinion 1: Microbots are tripping hazards

We have gathered a broad range of opinions based on our learning that cleaning companies are currently tending towards an “either/or” decision. Here are the most frequently mentioned arguments favoring large robots – and against microbots.

1. Safety concerns

Since microbots are smaller and lighter, there is a risk of theft or damage. These devices could be knocked over unintentionally or even stolen, which is a particular risk in public or poorly monitored areas.

2. Performance

While large robots can efficiently clean large areas, microbots quickly reach their performance limits. They are unsuitable for cleaning large, expansive areas or can only be orchestrated with great effort.

3. Lack of multi-functionality

Microbots have seen rapid development in terms of cleaning performance and quality in recent years. Nevertheless, it cannot be overlooked that vacuum cleaner robots, in particular, prevail in the microbot segment. Their performance in “mopping” is not yet convincing. The availability of multifunctional devices that can perform several tasks simultaneously and to a high standard is not yet in sight.

4. Clarity

Anyone who buys a swarm of small devices must also take care of a swarm of small devices. Where many robots are at work, many can also fail or not perform. The number of necessary tests increases dramatically. Serious fleet

management is inevitable.

5. Centralized maintenance for large robots

On the other hand, centralized maintenance is an option for large, high-performance robots. Large machines require less coordination than a fleet of microbots. They can be maintained and operated by a specialized team, which reduces the administrative burden.

6. Longevity and robustness

Large robots are usually more robust and resilient to faults or damage. Their technology is designed to work reliably, even under challenging conditions. ■

Opinion 2: Microbots are key

Despite the challenges, microbots can advance automation in the cleaning industry. Their flexibility offers numerous and invaluable advantages, especially in dynamic work environments.

1. Cost savings and good ROI

Microbots are considerably cheaper to buy than large machines. For companies that want to automate their cleaning processes, they offer a cost-effective way to do so without having to bear high investment costs. The rapid achievement of ROI makes follow-up investments more likely. Small cleaning companies can offer their customers automation solutions without investing too much capital.

2. Modularity and scalability

A fleet of small robots makes it possible to scale cleaning as needed. Companies can ex-

pand their microbots depending on the scope and complexity of the tasks without immediately investing in expensive large machines.

3. Plug and play

Microbots usually do not require extensive training. Many products can even be started without an app – simply by pressing a button on the device. Thanks to this, using microbots is self-explanatory, and large-scale training is not required.

4. Reliability

Long downtimes and waiting for particular spare



Michael Lackner, CEO Dr. Sasse Facility Management GmbH

“Microbots are the entry point for FM service providers into automation, so the weighting in the ranking is only logical.”

Infrastructural facility management has always been highly individualized, and automation should be approached in the same spirit. Only microbots allow a pragmatic and organic approach that considers our industry and its needs. Don't get me wrong, we use a three-digit number of large machines in the group, but we are betting – most recently with an investment in another 150 Microbots – that they are justified and will maintain their position in the long term.

parts are the Achilles' heel of automated cleaning. Objects need to be cleaned, whether by robots or by human hands. Microbots can be quickly replaced due to easy shipping and comparatively low costs. This prevents long downtimes.

5. Easy integration into existing work processes

Microbots can be easily integrated into existing facility management structures without requiring extensive infrastructure adjustments. For example, even "drop-and-go" scenarios are standard practice in the hospitality sector. Here, cleaning staff drop off a microbot in one hotel room while performing other tasks, such as cleaning beds, in the next room.

6. Doing dirty work where large robots can't go

Microbots can be used in more complex environments requiring accuracy and flexibility. They are ideal for confined spaces and hard-to-reach areas that large machines can't access. These little robots are helpful in cleaning surfaces under tables, chairs, or plumbing fixtures. ■

Takeaway: Think of automation holistically

Robotic cleaning is at the beginning of a significant transformation, and it is clear that both microbots and large robots have their place. However, to realize the full potential of automation, these two models must coexist and be combined.

For robotics manufacturers, this means focusing on something other than developing a single technology. Solutions that integrate large machines and microbots into a single system could shape the industry's future. Manufacturers also need to develop flexible platforms that can coordinate and optimize different types of robots.

For facility managers, this means looking closely at the specific requirements of their cleaning environments. In many cases, using both small and large robots to cover different cleaning needs will make sense. Understanding how microbots and large robots can best work together is critical to maximizing efficiency and profitability.

The ranking shows that, particularly in Europe, the mix of different robot classes has already arrived. One thing is clear: due to the current structure of manufacturers' ranges, mixing device classes also results in mixing manufacturer brands. This phenomenon is also clearly visible in the ranking.

The future of cleaning robotics will require the coexistence and integration of both models. The industry's challenge will be to seamlessly combine these two technologies and benefit from their respective strengths to create the greatest possible value for all parties involved. ■

Learning 3

Who's afraid of robotics? – and why our results show that this fear is unfounded



For decades, manufacturers, dealers, and FM service providers have worked together in a well-established triad: manufacturers develop and produce cleaning equipment, dealers distribute it in close regional cooperation, and service providers use it at the end customer's premises. This construct is stable, familiar, and based on long-standing personal relationships. However, with the introduction of robotics into cleaning, fear of change is growing in all parts of this chain.

Pressure on manufacturers

A central element of fear of change is the strategic pressure to which established manufacturers are exposed. Many of them have invested decades in perfecting their products. The idea that robots could challenge this decades-long expertise in just a few years is a source of uncertainty. You often hear statements like, "Robotics will not replace humans" or "The market is not yet ready for such technologies." However, these statements are not so much an expression of realism as a sign of fear of change. In technological terms, cleaning is already ready for automation – it is challenging to implement.

Manufacturers are feeling this pressure, especially from new players in foreign markets. Robotics companies that initially had nothing to do with the cleaning industry are entering the market. They not only bring technological expertise but also massive investments from international investors. This financial backing allows them to invest heavily in sales and marketing, painting a picture that significantly distorts progress in robotics.

Pressure on dealers

Robotics also pose a threat to regional dealers. Until now, they have played the role

of consultants and service providers, presenting the latest innovations to their FM customers and helping them choose the right cleaning equipment. However, the introduction of robotic machines is changing this business. Robots require much advice and maintenance and demand a new sales and service approach. In addition, the robotics business has yet to become a substantial revenue generator for many dealers. As is often heard in the industry, many robots "stand in the corner and gather dust." The initial euphoria surrounding the exclusive contracts with new manufacturers has subsided, and many dealers have realized that robotics involves more effort than profit – at least at the present stage. While some innovative dealers try to position themselves as robotics specialists, most remain skeptical.

Pressure on FM service providers

As described in the "Industry Sentiment" learning, the industry is in a phase of exploration. FM service providers urgently need to build up expertise in robotics to continue offering their customers the full range of facility management services from a single source in a future-proof manner. For the foreseeable future, end customers will no longer want to be available as pilot customers but will benefit from automation. ■

What our results and research suggest

1. FM service providers remain irreplaceable

The know-how for efficiently using robotics is currently being developed worldwide, especially by cleaning service providers. The purchase of hardware alone is not enough. A broad knowledge of suitable cleaning agents, the ability to develop holistic cleaning concepts, and knowledge of regional regulations are required. These are disciplines in which facility management companies have always been at home.

Our ranking and research do not support the concern that dealers and end customers could bypass the FM service provider. An independent investment in robotics only makes sense for end customers with their own FM organization, such as hotel groups that use their staff to clean the rooms and want to use robotics to support them in their tasks.

2. Dealers remain in the saddle for the time being

Dealer companies that have been established in the cleaning industry for decades remain the first point of contact for their customers when it comes to robotics. It will be crucial to maintain this individual advantage and to be able to provide competent answers to customers' automation questions.

One particular circumstance helps here: the good regional networks and perfect knowledge of their respective markets make established dealers highly interesting, especially for foreign robotics manufacturers. These manufacturers depend on the credibility of the dealers to boost their sales in foreign markets.

One thing is clear: full-service providers should be careful that competitors do not use an open "robotics flank" to present their entire range.

3. Robotics is causing a stir

There is no reason to be afraid, but it cannot be denied: robotics is causing quite a stir in the market. Cleaning companies are suddenly setting up specialized retail companies (such as the Wackler Service Group in Germany). Others are even investing in robotics manufacturers (Reiweg in LionsBot). SoftBank Robotics Singapore is going the other way and acquiring Millennium in Australia. Two manufacturers, LionsBot and Nilfisk, are launching a joint robot. Things are happening.

4. New manufacturers from other sectors are entering the market

For a long time, cleaning robotics was a neglected field. The music played in other

areas, such as intralogistics. Recently, however, it has become apparent that manufacturers from China, in particular,

are suddenly seeing the most significant potential in cleaning robotics for gaining a foothold in Western markets. The best example of this is the delivery robot experts at PUDU. With their compact PUDU CC1, they have declared war on the industry. The same applies to Keenon, which is updating and expanding its range of cleaning robots. A slowdown in development? Not in sight.

5. Automation as part of tenders

The big push may be happening later, but corporate real estate managers expect their service providers to stay on the ball regarding robotics. Even if the actual use of robotics is always pushed further into the future, it is often already part of tenders today. ■

Learning 4

Different markets = different uses of robotics



The development of cleaning robotics has varied worldwide in recent years, shaped by the specific requirements of regional markets.

Our ranking of fleet operators also shows that the markets in North America, Europe, and Asia sometimes differ significantly in their use of robotics. We shed light on the challenges and opportunities this presents for fleet operators and the long-term implications these differences have for the industry.

North America:

large machines for large areas

In North America, large-scale retail formats such as supermarkets and malls dominate. These require cleaning robots specialized for large, often stony, floor areas. Autonomous ride-on machines, such as those resulting from the collaboration between Braincorp and Tennant, are prototypical here. The demands on the machines are high: they must combine robust performance and ease of use, as they are often used in commercial suburban environments.

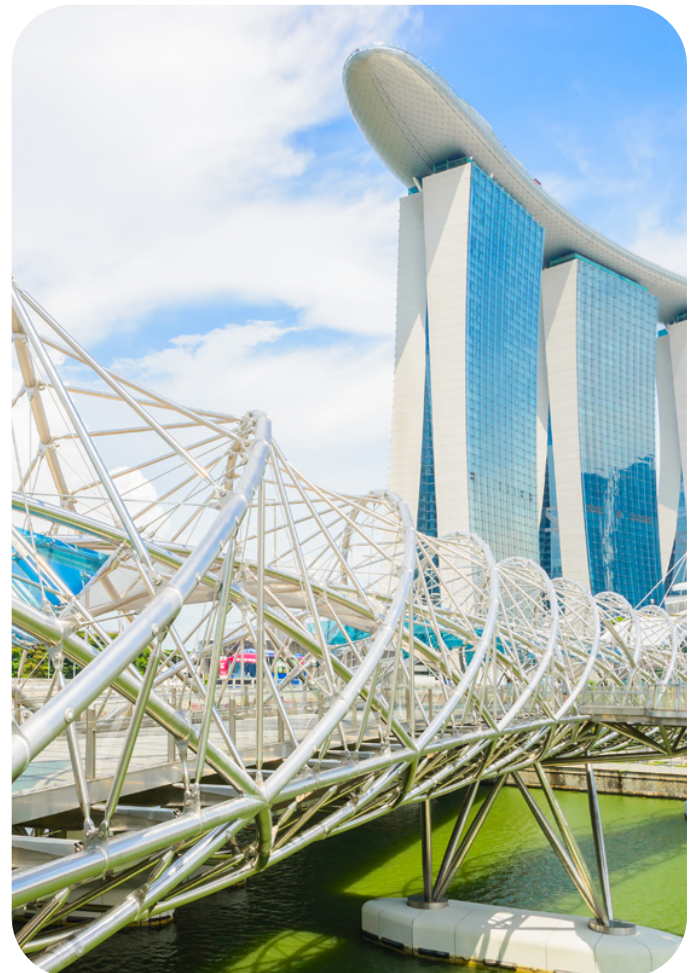
Europe: segmented demands

Europe shows a broader segmentation of markets. Medium-sized retail spaces and office buildings dominate continental Europe, while the hotel industry particularly characterizes the UK. Scrubber driers are often used for medium-sized retail spaces, while carpet cleaning and wet vacuuming are particularly in demand for office cleaning. In the UK hotel industry, on the other hand, the “drop-and-go” approach is becoming more prevalent: simple, cost-efficient microbots to support cleaning staff.

Asia: a growing, diversified market

Asia, especially China, is known for its innovative strength in delivery robotics. On the other hand, cleaning robots still have potential for growth here, particularly in emerging markets such as

small convenience stores or airports. In South-east Asia, with countries such as Singapore and Thailand, government subsidies promote robotics, which suggests that we can expect dynamic development in hospitality and small-scale retail.



In Singapore, the automation of cleaning services, e.g., at Changi Airport, is driven forward by government funding. (Photo: mrsiraphol freepik.com)

Challenges for fleet operators

1. Process requirements and technical diversity

The different market requirements demand a wide range of skills and strategies from fleet operators. While the processes for large-area cleaning machines in North America need to be established, smaller devices in Europe or Asia require less technical but more logistics-oriented management. Fleet managers have to adapt their processes to master the complexity of different robotic solutions

2. Scalability and market diversity

One key challenge is whether fleet operators can operate globally or are limited to regional markets. Differences in cleaning requirements, cultural acceptance, and business models make a uniform strategy difficult. Regions with clear focal points, such as the UK, with its labor-related focus on the hotel industry, could rely more heavily on local providers. At the same time, in other regions, concentrating on large manufacturers could make fleet operators more scalable in the long term

3. Partnerships are key

Local players play a crucial role in the successful operation of fleets. They provide market knowledge, which is essential for selecting and implementing the right robots and the logistical infrastructure for maintenance and operation. Access to experienced partners is a competitive advantage, especially in regions with complex or heterogeneous markets.

Our conclusion

Automation of cleaning is still rarely thought of in global terms. As in the past, service providers, with a few exceptions, are strongly committed to their home markets – and often only represented in countries where the same language is spoken. Accordingly, the current boundaries of cleaning robotics also apply. Different markets have different preferred uses for robotics. It already delivers reliable results with a cost advantage in the respective niches. Global fleet operators must recognize this diversity and use it strategically to succeed in both established and emerging markets. Partnerships, market knowledge, and a clear differentiation of use cases will be the decisive factors in mastering the complex requirements of the various markets. However, whether global standardization is possible or even necessary remains an open question that will shape the further development of the industry. ■

Which manufacturers are represented where?

There are still clear regional preferences in the market penetration of individual manufacturers. In North America, the US manufacturer Tennant and the Canadian robotics experts from Avidbots dominate. Chinese manufacturers are gaining a foothold in Europe, while European manufacturers are solid in the microbots segment. Singapore is strengthening its domestic brands, but the Chinese market remains a blind spot for foreign countries.

1. North America:

Tennant, Avidbots and ICE Cobotics dominate

Unsurprisingly, North American brands Tennant and Avidbots dominate their domestic market. Tennant is known for its wide range of autonomous floor-cleaning machines that cover a variety of applications. Some of the most prominent machines include:

T7AMR: A compact ride-on scrubber dryer ideal for large open areas such as airports and convention centers.

T380AMR: Designed for smaller spaces and narrow aisles, suitable for facilities with limited space.

T16AMR: Tennant's most powerful machine, designed for medium to large-sized facilities such as warehouses.

With the X4 ROVR, Tennant is also introducing the first product designed as a fully autonomous machine. Avidbots is another major supplier in North America, mainly known for the Neo, an autonomous floor-cleaning robot. This robot

offers fully autonomous cleaning and uses advanced AI-based software for dynamic planning and obstacle avoidance. The Neo 2W version is specially designed for warehouses and industrial environments and is used by DHL North America, among others.

Interestingly, based on the ranking and our research, the Chinese manufacturer ICE Cobotics, which plays a rather minor role in the European market, is extremely well represented in the USA. On the one hand, the large sales figures at the largest chain stores help, but notable successes in the education sector also play a role.

2. China and Asia: on the domestic market and in developing markets

In China, many companies are strongly represented in the domestic market but are increasingly expanding their reach to international markets. Manufacturers like Gausium and Pudu Robotics focus heavily on Asian markets and are slowly working their

way into Europe and the US. It certainly helps that the Chinese government has proclaimed robotics in all sectors as a key growth driver for the Chinese economy in the coming years and decades. Gausium offers a wide range of autonomous cleaning robots and has recently closed a financing round to drive expansion into new markets. The company is known for its AI-based floor cleaning and delivery robots. With Phantas, the Shanghai-based company has created a real success story that is also very popular in the European market thanks to its compact design. The most recent example is the order for 170 Gausium Phantas from the drugstore giant ROSSMANN.

Through international alliances, LionsBot, founded in Singapore, is working to raise capital and improve access to the European market. The company's first successes are already visible in the ranking. Among others, the German FM heavyweight WISAG now relies entirely on Singaporean robots.

3. Europe: innovative solutions with microbots and large robots

In Europe, smaller microbots and larger robots have established themselves on the market. That is why European fleets also show the highest brand and device class diversity in the ranking.

In addition to the microbot manufacturers Nexaro, i-team, Cleanfix, and ZACO, there is still enough space for niche providers with specialized solutions, e.g., for industrial use. One example is KEMARO from Switzerland, which has developed the K900, a robotic

sweeper particularly suitable for use in production plants and warehouses.

With Asian manufacturers' increasing importance to the European market, it will be interesting to see how European manufacturers such as KEMARO, ADLATUS Robotics, or Kärcher defend themselves and use their home advantage in the coming years. ■

List of manufacturers

With so many manufacturers, it can be easy to lose track of what's what. That's why we've put together a directory of manufacturers as an additional service.



<https://radar.fieldbots.io/list-of-manufacturers/>

Learning 6

These sectors are performing best

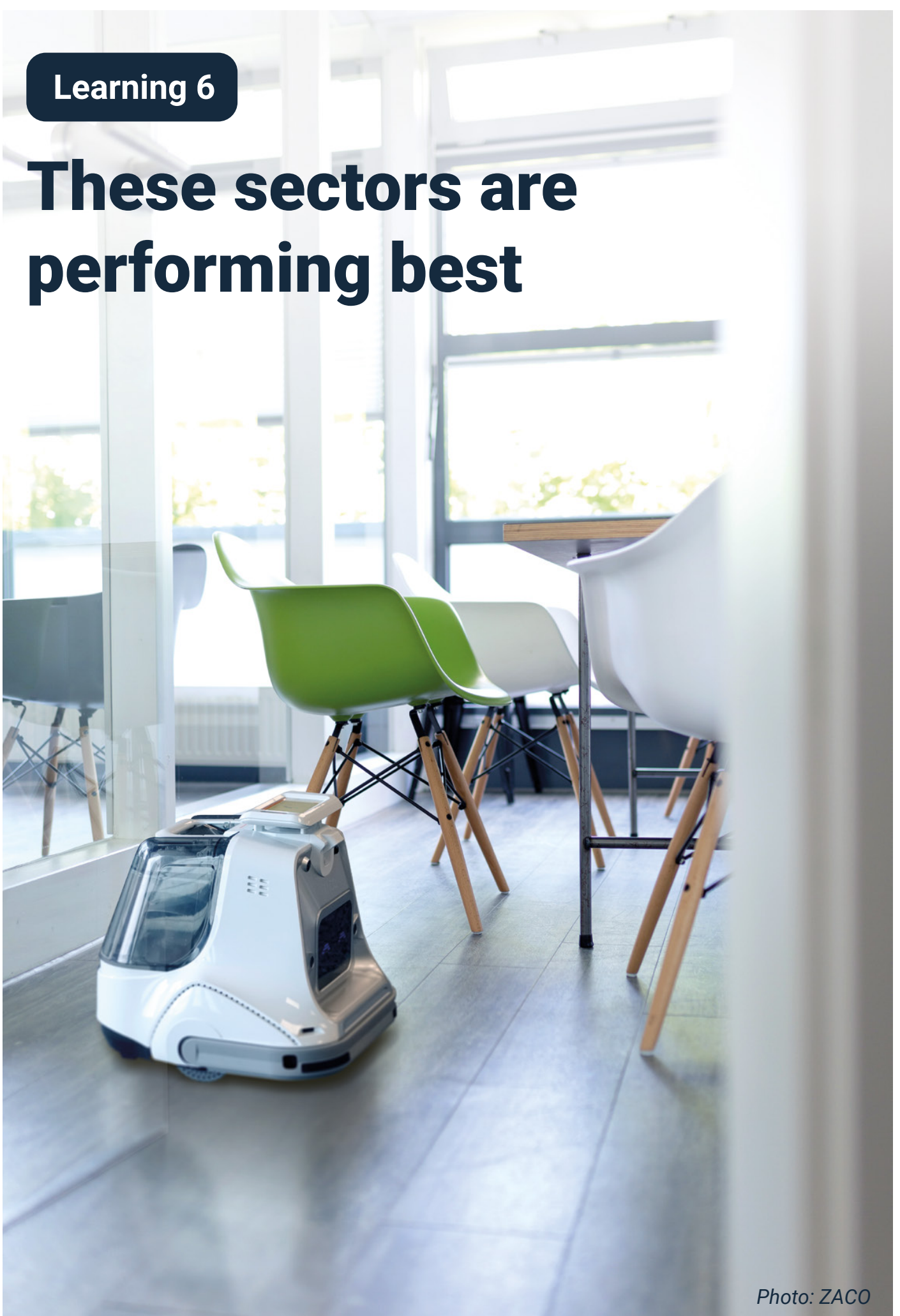


Photo: ZACO

The informative value of the Biggest Fleet Ranking should still be treated with caution, but it does at least indicate trends in market penetration. We expected some results, but we also discovered some unexpected ones.

1. Infrastructure: Airports and metro stations

One segment in which cleaning robotics is particularly well represented is infrastructure, especially airports and metro stations. Robots can cover large halls, corridors, and waiting areas without interrupting operations. In some cases, airports are also seen as national or regional flagships, so political pressure may have led to a rapid adoption of cleaning robotics. As in all sectors, the COVID-19 pandemic has catalyzed cleaning automation.

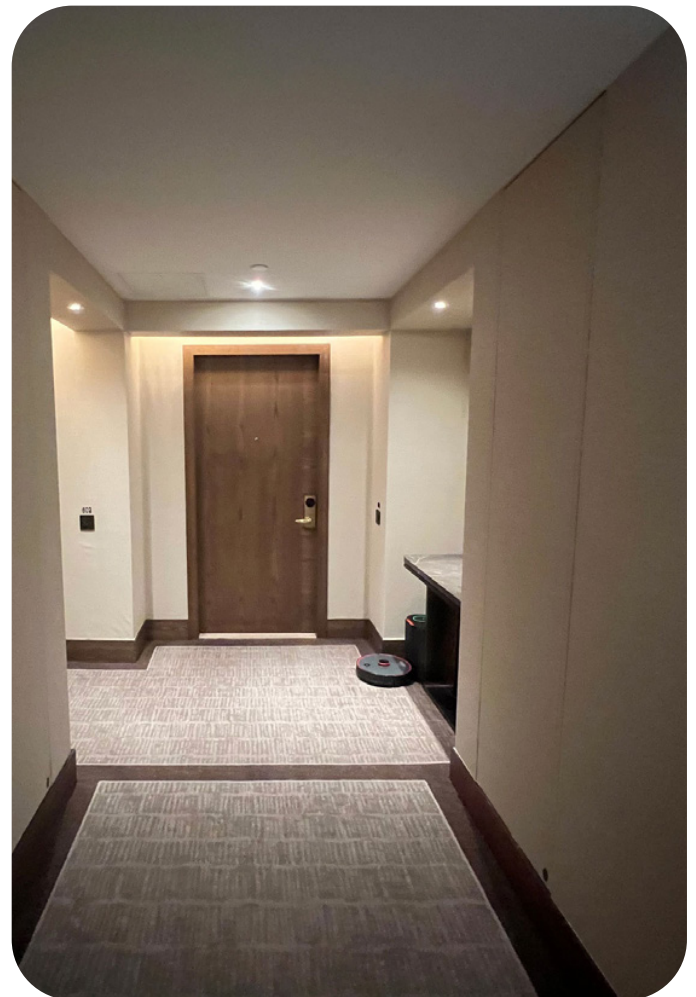
2. Retail: Supermarkets and retail

Cleaning robotics is rising in retail, especially in large supermarket chains such as Walmart in the USA, MAXI in Serbia, and ROSSMANN in Germany. There are many reasons for this: high customer expectations of cleanliness, the need to relieve the burden on staff, and noticeable cost savings. In many supermarkets, robots perform tasks such as vacuuming or mopping, allowing staff to focus on customer service or checkout. In addition to cleaning robots, the possibility of constant inventory by robots is of particular interest to chain stores.

3. Hotel industry: Microbots in hotels

The hotel industry has also established itself as an essential field of application for cleaning robots, especially for smaller, mobile models known as microbots. These robots are used in hotel rooms in particular. While the cleaning staff prepare the next room, the microbots do smaller tasks such as vacuuming or cleaning floors. In-

terestingly, it has been shown that both economy and luxury hotels are increasingly turning to this technology. This approach has already been successfully implemented in the UK, Singapore, and Germany.



*Automated cleaning in the hotel industry using microbots
(Photo: FieldBots)*

4. Education sector: Universities and educational institutions

Cleaning robots are also becoming increasingly widespread in the education sector, especially in large university institutions with numerous corridors, lecture halls, and sports halls. Large cleaning robots have long been a familiar sight in universities and high schools, particularly in the USA.

5. Office market: surprisingly behind

In the office sector, cleaning robots are not as widespread as in other areas. Yet here, too, robotics could be used to significant effect. Particularly in large office buildings, where there is a high staff turnover and numerous small, sometimes complex cleaning tasks to be performed, cleaning robots offer an efficient solution. Transferring lessons learned from the healthcare and hospitality sectors may be possible.

6. Healthcare: cleaning robots in clinics and hospitals

The healthcare industry shows how versatile cleaning robots can be. Large robots are used to clean long corridors and vast areas in hospitals and clinics, while microbots are used to clean smaller and more complex rooms precisely. This mix of robots offers advantages in terms of cleaning efficiency and hygiene, as they guarantee a consistently high level of cleaning performance that is often difficult to achieve manually. In hospitals and care facilities, they help to reduce the workload of cleaning staff while increasing hygiene standards. Therefore, it is not surprising that hospital networks in the US are pioneers in cleaning robotics.

7. Logistics: large robots for large areas

Large cleaning robots are essential in the field of logistics. These robots are necessary to clean large logistics centers' extensive warehouses and production halls. Companies such as Avidbots, which works in partnership with DHL, among others, are counting on the logistics industry as a growth market. Cleaning robots from companies such as KEMARO, PUDU, or REEMAN can also establish themselves in this industry and offer a fast and reliable solution for cleaning large areas.

8. Production: Precision and integration into production processes

The production sector poses a particular challenge for cleaning robots. The machines must be robust and integrate perfectly into existing production processes. Cleaning robots must not disrupt the production process, as any interruption can result in potentially expensive downtime. Therefore, the introduction of cleaning robots is approached with more caution here. The robots must work flexibly and reliably and, in the best case, can work with other automation systems in production through standardized protocols. ■



Learning 7

Our ten theses about the future of cleaning robotics. Which are probably all wrong.



Robotic cleaning has experienced a remarkable upswing in recent years and shows no signs of slowing down. But what developments can be expected in the coming years? Given the different regional markets, technological advances, and changing industry requirements, profound change will characterize the coming years. Based on our observations and market analyses, we venture into the future of cleaning robotics and derive ten theses from them.

1**The gap between low-cost and high-tech robots will continue to widen**

In the future, cleaning robots will increasingly be divided into two main categories: low-cost models for simple tasks and highly complex machines for more demanding environments. This will further diversify the market for robots and require specialized fleet operators.

2**Regional customization will be the critical success criterion**

Global players will increasingly need to adapt their robotic solutions to regional needs and market conditions. While large-scale machines dominate in North America, smaller, more flexible robots will be in demand in Europe and Asia. Only manufacturers, dealers, and fleet operators who understand these regional differences will be more successful in the long term.

3**Artificial intelligence will be at the heart of cleaning robots**

We know that this is not a particularly groundbreaking thesis. However, we are sure that artificial intelligence will develop from a current marketing argument into a real selling point. It will no longer only play a role in autonomous navigation and mapping but also in the continuous improvement of cleaning efficiency and precision.

4**“Drop-and-go” solutions will dominate in specific markets**

Easy-to-implement and cost-effective “drop-and-go” solutions, such as those used in the hospitality industry and small retail spaces, will continue to grow in popularity. These solutions are critical in regions with labor shortages or high labor costs.

5**Profitability will increasingly depend on fleet management**

Efficiently managing fleets will be one of the biggest challenges for operators. Integrating connectivity and advanced fleet management will be critical to how profitable these technologies can be at scale.

6**The adoption of cleaning robots will depend on the availability of labor**

In markets with high labor availability (such as some Asian countries), robots are seen as complementary rather than substitutive. In contrast, robots may increasingly be seen as necessary in countries with labor shortages or high labor costs (such as the UK and Germany).

7**Government funding will be a crucial growth factor in specific markets**

For example, government funding programs, such as those in Singapore, will play a pivotal role in the growth of cleaning robotics. Particularly in developing countries or emerging markets, this will accelerate the introduction of new technologies and lead to broader acceptance.

8**Cleaning robots will also catch on in areas with high customer contact**

All experiences in highly frequented locations point in one direction: cleaning robots do not disturb the public. While robots are still a highlight in themselves, people will get used to seeing them daily.

9**Next up: robotic lawnmowers and security robots**

There are already other niches, such as cleaning PV systems, in which robotics will prevail. However, what is particularly exciting is the question of which areas service robots will be widely adopted in the future. We are confident that green space maintenance and security offer massive potential for automation and that robots in these areas have long since passed the proof-of-concept stage. Incidentally, it will take one or two more innovation cycles before automatically cleaning windows and stairs.

10**Facility managers will dominate the field of cleaning robotics**

With the necessary workforce, the ability to set up cleaning concepts, and knowledge of the correct use of cleaning liquids, FM companies will be the main drivers of robotics.

European expert: Martin Haubensack

How did you get into cleaning robotics?

I have been working in the cleaning industry for almost 25 years now. During this time, I have seen many innovations, and it is inevitable that you will automatically come into contact with the latest technologies. Autonomous cleaning has been with me for eight years and fascinates me daily.

Do you have robots at home?

We have two microbots at home. One model for vacuuming and a second, newer model that also does wet cleaning to a level that I find acceptable. As cat lovers, modern technology helps us keep the apartment clean, which is a real challenge with three Maine Coon cats at home.

How does your company go about bringing cleaning robots to market?

Our goal is not just to sell our customers a cleaning robot. Even though that is, of course, our main task. For us, robotics means more than that and must always be thought of as part of a solution. Remote control, automation,

elevator integration, communication with the building infrastructure, and VDA5050 are just a few examples of the solutions we want to offer our customers. Of course, working with partners like FieldBots is also an essential part of the overall solution. This is where the strengths of the PHILON team come into play because we are happy to pass on our knowledge to our customers in the form of consulting, project management, and implementation.

Where can we find the largest fleets in your market and why?

We recently won a significant order from and with ROSSMANN. The first 40 devices have already been delivered and operated in North Rhine-Westphalia. Another 130 units will follow throughout Germany at the beginning of 2025. I am convinced that our PHANTAS robots will attract the attention of other customers in the coming weeks because the customer made his decision for this model precisely because of its simplicity, flexibility, and reliability. Of course, the cleaning result was also evaluated. Compared to other products in this



Martin Haubensack

CEO Philon Reinigungsservices AG



With over 15 years of professional experience, the founders of PHILON Service Robotics AG support companies in implementing autonomous cleaning and service robots.

More information: <https://www.psr.ag/>



Hot off the press: the largest single order in the history of German cleaning robotics. 170 Gausium Phantas will soon be starting work in ROSSMANN stores (Photo: PHILON Service Robotics AG)

class, the Phantas, our service, and our know-how stood out and ultimately led to success.

How would you describe your market compared to other markets or continents?

I think other countries and continents are much more comfortable with robotics than we are here in Central Europe. This may be due to our legal regulations and requirements. An enormous focus on data protection certainly plays a role here as well. Moving cameras can almost cause a German to break out in a cold sweat. I think digitization and automation have not yet fully

arrived in the business world.

Interestingly, things often look different when it comes to software and the use of artificial intelligence. However, as soon as physical movement comes into play, the reluctance in our market is still clearly noticeable.

The positive thing about this caution is perhaps that there is no blind euphoria in Europe when it comes to robotics. I have noticed that in North America, things are often done first – and then the wounds are licked later. By the way, one market that I previously didn't even have on my radar is Africa. There is industry here, too, and there is hospitality and education here, too.

The same applies to South America. We still have a few blind spots and plenty of growth potential.

How far are we from the widespread introduction of cleaning robots? What will “The Biggest Fleet” tell us in one year, five years, ten years?

We still lack a product that can solve several tasks at once. The current robots are too specialized for this. There are various research approaches, from the Fraunhofer Institute in Germany and other institutions, in which attempts are being made to combine air quality measurements or real-time inventories with cleaning, for example. So far, however, none of this is tangible and it is far from being market-ready.

I see a multi-zone solution like this as a prerequisite for a broad willingness to invest – thus, for a broad robotics rollout. I hope something will happen in this area in the next year or two. I don’t want to look much further into the future. Fortunately, the leaps in innovation in our industry are too great for that.

What are the biggest obstacles that cleaning robots have to overcome?

There are widespread fears regarding data security, primarily concerning Asian robotic products. However, this caution often lacks a technological basis. Political posturing certainly plays a role here.

A second point is that robotics manufacturers often come from a software background. They then put much effort into developing a mechanical shell around it. They often lack know-how in the field of cleaning technology, which is ultimately reflected in the cleaning

quality of the products. On the other hand, established cleaning machine manufacturers are heading in the opposite direction. They are trying to build (software) logic into their shells. The result is very similar. Although the robots clean excellently, they need help with navigation or problem-solving skills.

Further hurdles are time-consuming deployments and, in addition, active management of the devices is needed to maintain or improve cleaning quality. Interestingly, however, these hurdles, which can only be overcome through technology, also open the door to new profiles of young employees who would otherwise not be interested in the cleaning market as their professional future.

Are microbots a thing in your markets?

Microbots definitely have their place. Large and cost-intensive robots can only be installed in some environments. Just think of hotel corridors or angled environments with stairs in between. These scenarios cannot be mapped by one device. So, there is no way around microbots here. For us at Philon, the decisive factor for liability reasons was that microbots are also B2B certified and approved. That is why we have only been active in this area for six months. However, we can already see that our customers receive the small robots well.

What’s next in cleaning robotics? What is the following discipline of cleaning automation after vacuuming and wet mopping?

We have already discussed combined robots that can perform multiple tasks, active fleet management, and the role of the robot manager. What I think is an exciting idea is a kind of

modular system – in principle, a platform solution that allows users to configure robots with different capabilities, not unlike a LEGO® brick or puzzle. Regardless, I think cleaning sanitary facilities and facades will be the subject of future automation. When it comes to facades, I am thinking of cleaning large glass surfaces, brickwork, or plastered surfaces. There is a massive demand for a robotic solution here, if only for risk prevention. ■

Asian expert: Dr. Tamaki Horii

How did you get into cleaning robotics?

I'm currently the head of the Business Innovation Division at Obayashi Corporation. Our division creates new business opportunities and expands the Obayashi Group's portfolio. So far, we've spun out three companies. One, PLiBOT, provides robotic solutions for the construction and manufacturing industries. Oprizon, Ltd., offers smart building services, including networking systems, meeting automation, and energy usage tracking. We recently launched a new data center project team, and there are 20-30 ongoing projects under my leadership. Our goal is to spin out one or two companies each year.

The construction industry faces a labor shortage due to a declining and aging population, making robotic solutions crucial for boosting productivity. However, deploying robots on construction sites remains challenging. To address this, we launched a company to develop robotic technology for construction,

manufacturing, and other sectors. Our solution involves robots moving materials overnight, optimizing the 24-hour work cycle by synchronizing human labor with robotics. We also created a platform to control robots and construction site equipment, ensuring efficient coordination. Initially, we'll focus on stable industries like manufacturing to avoid the seasonal demand fluctuations in construction. Once established, we plan to expand into the construction sector.

Do you have robots at home?

Yes, a Cleanfix Navi S170.

How does your company go about bringing cleaning robots to market?

In construction, safety starts with keeping the site clean. We've been taught that a clean site is essential for safety because it allows workers to see alignment and avoid hazards. In Japan, this is a fundamental part of our construction



Dr. Tamaki Horii
Obayashi Corporation

Dr. Tamaki Horii is the Head of the Business Innovation Division at the Obayashi Corporation, one of Japan's Major Construction Companies. Among other things, his team was responsible for the spin-off of the company PLiBOT, which offers autonomous robotic solutions for cleaning, logistics, and material handling.



approach. However, it's often difficult to find labor for cleaning tasks, so we're exploring using robots to handle this instead. Robotics is one of our initial trials to improve safety and efficiency on construction sites.

Do you have a strategic approach for monitoring the market, seeing what new robots exist, and how to test them?

We've established close relationships with two to three venture capital firms, and we regularly meet to exchange information about startups and their robotic solutions. When we have POC opportunities, we offer construction sites for our own use and our subsidiaries, including those in the U.S. and Southeast Asia. This allows us to test and evaluate which robots are ready for deployment on construction sites.

Where can we find the largest fleets in your market and why?

Robots are typically used during off-hours, like after 5:00 p.m., as it's still uncommon to see them working during regular hours. Extensive facilities such as airports or race tracks are ideal environments for robots, as they cover vast areas. Deploying human workers in these spaces would require hiring many people, making robots a more efficient solution with lower switching costs. Another use case is in environments with challenging conditions, such as a beer factory, where dust or other particles are constantly in the air, and cleaning the floor is difficult. In such situations, robots can perform well, effectively maintaining

cleanliness in these specialized environments.

How about other markets? For example, hospitals and healthcare in general?

Currently, robots are not yet used in hospitals, particularly in Japan, due to constraints like the high-rise nature of urban hospitals. However, the demand for robots in healthcare is high, especially with the aging population and labor shortages. Tasks like moving patients between beds or assisting elderly individuals with daily activities are physically demanding for staff, and robots could help alleviate this burden. Additionally, strict cleaning protocols in hospitals, especially in virus-sensitive environments, create another area where robots could be helpful. Overall, the need for robotic solutions in healthcare is significant.

How would you describe your market compared to other markets or continents?

When I visited a hospital in Singapore, I saw widespread use of robots, which was quite impressive. The critical difference is that the government actively supports and incentivizes using robots, which has helped accelerate their adoption in startups. I wish the Japanese government would implement similar initiatives. I also visited China, where government policy played a significant role in driving the growth of startups. Many companies there emphasized that aligning their solutions with government policies was crucial for success. Since robotics is still an emerging technology, government and organizational support is essential for market

growth. Another critical factor is the mindset and process change required to integrate robots. Robots aren't meant to replace humans entirely but to work alongside them. Adapting work processes to leverage what robots can do while allowing humans to focus on tasks they're better suited for is crucial in successfully adopting robotic solutions.

In which terms is the North American or European mindset different from the Asian or Japanese mindset?

The mindset around robotics differs significantly across regions. In the U.S., there's an aggressive approach—once the benefits of a robot are clear, they adopt it quickly. In contrast, Japan tends to be more cautious and risk-averse, especially regarding uncertainty. For example, there's a strong focus on potential issues like robots accidentally injuring people or damaging property. Even if the risk is low, Japan is more reluctant to move forward without solid evidence that such problems are doubtful. Conversely, Europe strikes a balance between the U.S. and Japan with a more strategic approach to robotics adoption. They tend to be more measured and thoughtful, incorporating robots in a way that aligns with long-term goals while managing risks.

How far are we from the widespread introduction of cleaning robots? What will "The Biggest Fleet" tell us in one year, five years, ten years?

I believe Japan will experience significant changes in the next five to ten years, especially as the population continues to decline and the birth rate decreases. Japan has already reached a

demographic turning point, and the population will likely continue to shrink over the next few decades. The construction industry is bustling, partly due to the rapid economic growth in the 1970s and 1980s, which led to significant infrastructure investments. Many of these facilities are now aging and in need of replacement. This creates an opportunity for private owners and the government to rebuild or upgrade infrastructure, a trend that should continue over the next five to ten years.

Facility owners should replace old infrastructure and rethink how to manage it more efficiently. In the future, maintenance tasks like cleaning could be automated with robots, and data could be managed smarter, using software to monitor and control facilities more effectively. So, while these changes are still emerging, I think they'll become more widespread in the next five to ten years.

What are the biggest obstacles that cleaning robots have to overcome?

Pricing is definitely a key challenge for selling robots, particularly when it comes to replacement costs. We're always concerned about how to make the robots affordable while maintaining quality. However, there's a trade-off: the more units we sell, the more we can reduce the cost per robot. The real challenge is finding early adopters—users who are excited about the idea and ready to embrace the solution quickly. When it comes to cleaning robots, the main complexity lies in the user interface. Even if customers love the solution, daily users like janitors often aren't familiar with computers or robotics. Simplifying these processes will be

vital to improving the overall user experience. So, the interface needs to be as simple and intuitive as possible. It would be ideal if we could make it easy for them to understand how to use the robot without needing specialized knowledge.

What's next in cleaning robotics? What is the following discipline of cleaning automation after vacuuming and wet mopping?

One area I find particularly interesting is using robots to clean narrow spaces like pipes and tubes. This is a real challenge in Japan due to the aging infrastructure, particularly water and sewage pipes installed many years ago. Maintaining these pipes is a significant burden for the government, and cleaning robots could offer a potential solution. If such robots were developed, they could attract considerable attention from government agencies dealing with these infrastructure issues. ■

Let's move this industry. Together.

An initiative of FieldBots Radar for the cleaning robotics industry

**Biggest
fleet
— 2024**

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